THE

MODUS OPERANDI

OF VARIOUS KINDS OF

Baths, Sea-Bathing, Heat and Cold,

PHYSIOLOGICALLY EXPLAINED.

By JOHN O'REILLY, M.D.,

Licentiate and Fellow of the Royal College of Surgeons in Ireland; Resident Fellow of the New York Academy of Medicine; Member of the Medico-Chirurgical College of New York; late Medical Officer to the Oldcastle Workhouse and Fever Hospital, Ireland.

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PREFACE.

The following pages were written with the object to confirm the original views heretofore promulgated by me, as well as to illustrate, in a practical manner, the necessity of every medical man being thoroughly conversant with the laws which regulate and govern the functions of the animal and organic nervous systems, the Oxygen and the Blood.

I do not pretend to know more about the preparation of Baths, or the effects produced by them, than any other member of the profession; my sole desire being to demonstrate why and how medicines, when administered internally or applied externally, are followed by certain effects.

Let it be remembered, my great aim is, the exposition and elucidation of grand, comprehensive, fundamental principles, without allowing myself to be fettered and become mystified with superfluously minute details; in other words, to be grasping at mere shadows, instead of seizing on plainly visible facts.

May 17th, 1861.

VARIOUS KINDS OF BATHS.

MODUS OPERANDI *of the Warm Bath—Good Effects produced —Prevents Fever and Inflammation—A good Remedy in Strangulated Hernia—Bad Effects of Ice—Remarks on Hernia—Fainting caused by the Warm Bath—Mode of Resuscitation—Marshall Hall's Method of Treating Asphyxiated Infants explained—Philosophical Explanation of the Mode in which Infants born apparently dead are restored to Life—Efficacy of Cold Douche in Post-partum Hæmorrhage explained—Mode of Action of Ergot of Rye in arresting Hæmorrhage—How sprinkling an Infant with Cold Water resuscitates it—How Cold Air or Ice arrests Hæmorrhage after an Operation when oozing of Blood continues—Wound should not be dressed immediately after an Operation—Good Effects of Cold Douche in Fever and Encephalitis—How a Drink of Cold Water causes Death—State of a Wound after Exposure for three hours—Mr. Liston's Remarks—Mr. Macartney's Theory—Sir Astley Cooper's Ideas—Mr. Hunter's Views—Cold-Water Dressing—Particular Rules with respect to the Mode of Treatment of Wounds after Operations—Effects of the Cold Bath—Explanation of the Modus Operandi of the Cold Bath—Explanation of the Cause of Spasms by Cold—By Tetanus—By Strychnine—By Lead—By Asiatic Cholera—Treatment of Spasms produced by Cold Water—Modus Operandi of Salt-Water Bathing—Phosphorus—Chloride of Sodium—Good Effects of explained—Shower-Baths explained—Cause of Suspended Animation explained—Modus Operandi of Sulphur Baths—Iodine Baths—Nitro-Muriatic Acid Baths explained—Iodine recommended in Bright's Disease.*

When a person is exposed to the vicissitudes of the atmosphere and suffers bodily fatigue, one of the most agreeable remedies he can have recourse to is a warm bath, to recuperate his energy, and relieve the exhaustion and disagreeable sensations he labors under.

It is a question of some importance to know how the warm bath acts in dissipating the symptoms. A person, on being placed in a warm bath circumstanced in the manner just described, will experience a pleasurable or agreeable sensation; on being removed from the bath and placed in bed, he will soon be found in a general perspiration; the warm bath acts as a stimulant on the organic nerves surrounding the capillary arteries, dilatation of the capillary arteries is the result, a greater quantity of blood with a greater amount of oxygen thus passes into the capillaries, the organic glands commence to discharge their functions, some of the salts of the blood with the superfluous oxygen is united with the hydrogen of the serum of the blood, which is decomposed by the electricity, evolved at the moment of the union of the oxygen with the organic nervous tissue, when animal heat is generated, and forms serum, which passes off by the pores of the skin—the excretory ducts of the organic glands; in this way the sources of irritation to the organic glands are removed, the exciting cause of fever or inflammation is removed by the elimination of the offending matter from the organic nervous glands; thus it will be perceived that a warm bath not only gives comfort in the first instance to the patient, but prevents bad consequences at a more distant period.

In cases of strangulated hernia, a warm bath is a most efficient remedy if at once had recourse to, as it produces complete relaxation of the muscular fibres, on the same principle as tobacco, chloroform, and venesection; and if a patient is kept in the bath till he faints, reduction of the hernia may be easily accomplished. Whilst speaking on hernia, it may be well to remark, in passing, that the application of ice or ice-water need not be had recourse to if the warm bath fails; and the same remark is true of tobacco, chloroform, and venesection; the cold produces spasm of the capillary arteries through their connection with the organic nerves, and spasm of the muscular fibres through the connec-

tion of the latter with the nerves, so that the cold only adds to the difficulty, by increasing the intensity of the stricture; therefore, if the warm bath fails, not a moment should be lost in performing the operation for the relief of the stricture. Acting on this rule, I have been very fortunate in operating for inguinal and femoral hernia.

I wish it to be distinctly understood, that when a man faints in a warm bath, that life is temporarily suspended, and that all muscular power ceases; and further, that as venesection carried *ad deliquium animi*, is precisely followed by the same effects as fainting in the warm bath, that it would be losing time to have recourse to the lancet, on failure of the bath.

Tobacco produces total relaxation of the muscular system, through its deadly influence on the organic nervous system.

Chloroform also produces total relaxation of the muscles, through its action on the organic nervous system; it is evident that all that can be accomplished by venesection, by tobacco or chloroform, is relaxation of the muscular system, and therefore renders the administration of tobacco, chloroform, and venesection unnecessary.

If a person is kept too long in a warm bath, relaxation and exhaustion of the organic nervous system follow to such an extent, that the person will be deprived of muscular power, the heart will cease to contract, the pulmonary organic glands will cease to give off electricity to unite the oxygen of the air with the venous blood; hence fainting or suspended animation is the result.

What should be the treatment to restore the patient under such circumstances?

Firstly—Immediate removal from the bath into a draught of air.

Secondly—The application of cold brandy to the face, nostrils, lips, body and extremities.

Thirdly—Slapping the hands, feet, cheeks, and other parts of the body, and in addition a *small* dose of laudanum may be administered; the cold air and brandy cause contraction of the capillary arteries through the connection of the capillary nerves which surround them, as well as contraction of the muscular fibres of the muscles to which the arteries and nerves are

distributed; hence the contraction of the heart can be explained, and the deep sighs or suspiration which follow, in consequence of the heart sending the blood to the pulmonary glands, which stimulates them to give off electricity to unite the oxygen of the air with the venous blood, and by the subsequent union of the oxygen with the organic ganglia and glands, re-establishing the vital functions.

The slapping causes alternate contraction and dilatation of the capillaries, through the action of the organic nerves surrounding them; the truth of this doctrine must be admitted by every person who has witnessed arteriotomy of the temporal artery, when the blood ceases to spurt. *(Note A.)* It is well known, twitching the cut extremity with the finger and thumb will cause the blood to flow freely *per saltum*, so that any person can observe the alternate contraction and relaxation of the artery.

The laudanum, in small doses, causes contraction of the capillary arteries, through the organic nerves.

The late Dr. Marshall Hall stated the marvelous effects of warm and cold baths in restoring animation in an asphyxiated infant. The mode in which the baths act is susceptible of explanation: the cold causes contraction of the capillary arteries through the contraction of the nerves which surround them, and consequently contraction of the muscles to which the arteries and nerves are distributed. The warm bath produces effects diametrically opposite; hence, plunging an infant into cold water and warm water alternately, causes contraction and dilatation of the heart and arteries, and enables the pulmonary organic glands to evolve electricity to unite the oxygen with the venous blood, and thus provide for the resuscitation of life, by the union of the oxygen with the organic nervous ganglia and glands. The philosophical mode of resuscitating an infant born apparently dead can now be understood, namely: by cold air, warm and cold water baths, slapping the infant smartly, removing obstructions, in the shape of mucus, from the nose and mouth, washing the infant with spirits, as practiced by nurses. The cold air causes contraction of the organic nerves surrounding the capillary arteries; contraction of the muscles to which the arteries are distributed is the result; contraction of the muscles causes the venous blood to be

forced to the right side of the heart; contraction of the muscular fibres of the heart follows, in consequence of the connection of the organic nerves with the muscular fibres of the heart; the blood is now sent to the lungs; the pulmonary organic glands give evidence that they require oxygen, by the infant opening its mouth and endeavoring to catch air. The organic glands are now stimulated by the air—give off electricity—which unites the oxygen with the venous blood; on the union of the former (the oxygen) with the organic nervous glands and ganglia, all the functions which characterize life are present. The warm and cold water produces alternate relaxation and contraction of the arteries and muscles, through its action on the organic nerves, and invigorates the action of the capillaries, increasing the force of the circulation. Removing obstructions allows the air to enter the wind-pipe. The spirit causes contraction of the capillary arteries, through the connection of the organic nerves surrounding them, and thus, contraction of the heart through the nerves which supply its muscular fibres. In connection with this subject, I wish to observe, that when attending as a pupil at the Dublin Lying-in Hospital, I was told that infants supposed to be still-born, and who were placed in locations where their bodies were exposed to a draught of air, were soon afterwards heard crying, and rescued from an untimely grave. Here, the stimulus of the cold causes contraction of the arteries, through the connection of the retina of organic nerves which surround them, and contraction of the muscular fibres through their connection with the arteries and nerves, and contraction of the muscular fibres of the heart, through the connection of the muscular fibres of the heart with the organic nerves, which are so largely distributed to it; the blood, on being sent to the lungs, stimulates the pulmonary organic glands, which, at once, commence their functions, thus restoring life. *(Note B.)*

In cases of post-partum hæmorrhage, obstetricians are in the habit of dashing cold water on the genitals, with a view of arresting the flooding; and in many instances, this proves a very efficacious remedy. The question as to how the cold water stops the flow of blood is interesting, and one that is now susceptible of lucid explanation. The cold water, dashed with

force, causes a shock to the organic nerves surrounding the capillary arteries, causing contraction of the capillary arteries, and thus prevents the ingress of the blood into them. The capillary arteries, with the organic nerves surrounding them, supply the muscular fibres of the uterus, so that contraction of the muscular fibres of the uterus must follow, in consequence of the muscular fibres of the uterus being supplied with organic nerves; the hæmorrhage, therefore, is promptly arrested by the contraction of the uterus. It will be recollected that the uterus, after parturition, presents the character of a recently inflicted wound, and that the mouths of the capillaries are open.

Ergot of rye arrests hæmorrhage after parturition, precisely in the same way as the cold douche does; it causes contraction of the capillary arteries, and through them of the muscular fibres of the uterus to which the capillary arteries are distributed by its irritant operation on the organic nerves surrounding the capillaries.

The ergot of rye acts as an irritant on the organic nerves in the same manner as lead and strychnine; it is well known that lead arrests uterine hæmorrhage, and I am satisfied that strychnine would arrest hæmorrhage on the same principle as lead or ergot does, if properly administered.

The lead causes constriction of the capillary arteries through the connection of the organic nerves which surround them. *(Note C.)*

The ergot causes contraction of the capillary arteries through the connection of the organic nerves which surround them. *(Note D.)*

The strychnine causes contraction of the capillaries through the organic nerves which surround them; the lead produces spasm of the nerves; the ergot produces spasm of the nerves; the strychnine produces spasm of the nerves; therefore, the lead, ergot, and strychnine act in the same way. *(Note E.)*

Briskly sprinkling cold water on the face of a person who has fainted, or on the face or chest of an infant in a weakly state after being born, will cause contraction of the capillary arteries, contraction of the muscles, contraction of the heart, and a deep inspiration through the shock thus communicated to the organic nerves surrounding the capillary arteries, which supply the muscles and the organic nerves, which supply the

heart and pulmonary ganglia, which give off the nerves to form retinæ round the pulmonary arteries, and terminate in the pulmonary organic glands.

In cases of amputation of the breast, of the thigh, or the removal of tumors, some surgeons are in the habit of leaving the wound exposed to the cold air for two or three hours, with a view of preventing hæmorrhage; and in some cases where oozing of blood continues after all the arteries have been tied, it is customary to apply either pounded ice or cold water to the bleeding surface.

The *modus operandi* of the cold cannot now fail to be understood: the cold causes contraction of the capillary arteries through the operation of the organic nerves which surround them; hence no blood can pass through the capillaries, and hence the stoppage of the oozing of blood.

It is easy now to understand how heat produces hæmorrhage, and why it is desirable not to close or dress the wound for some time: the heat acts as a stimulant on the organic nerves surrounding the capillary arteries, causing dilatation of the capillaries, and, consequently, allowing a free entrance of the blood into them, which escapes through their wounded extremities; cold will produce a contracted state of the capillaries through the shock communicated to the organic capillary nerves surrounding them; heat, on the other hand, causes a dilatation of the capillaries through the organic nerves surrounding the capillary arteries, through its stimulating effects on them.

In some cases of fever, as well as in cases of encephalitis, the pain in the head is exceedingly severe; the temporal arteries, as well as the carotids, can be observed pulsating strongly; one of the best methods for relieving a patient so circumstanced, is pouring cold water on the patient's head, which should be continued till relief is obtained, and afterwards had recourse to as often as occasion requires; the cold water causes contraction of the capillary arteries through the communication of the organic nerves which surround them; hence the quantity of blood sent to the brain is diminished, as well as the heat and pain relieved.

When a person engaged in some violent exercise, and when greatly exhausted, takes a drink of cold water, he may suddenly fall dead; here the shock produced by the cold on the

organic nerves of the capillary arteries in the stomach, and on the glands formed by the capillary organic nerves at the termination of the arteries, is at once communicated to the cardiac ganglion, as well as the pulmonary ganglion; the heart is rendered powerless as regards its function of contraction, and the pulmonary glands rendered powerless as to discharging their function of giving off electricity to unite the oxygen of the air with the venous blood; hence life becomes extinct in the organic nervous ganglia and glands, for the want of oxygen to keep it in existence. It may be asked, Why a drink of cold water would not produce the same effect before violent exercise? The answer is obvious—namely—the organic pulmonary glands have become so exhausted as to be unable to discharge their functions efficiently any longer; the additional shock, therefore, of the cold destroys their power altogether, and places them in the same predicament as if hydrocyanic acid was taken into the stomach; the shock produced by the cold, under the circumstances, instantly paralyzes the organic nervous system, arresting all the functions of life, and destroying life itself; the hydrocyanic acid kills, precisely in the same manner; hence the analogy holds good.

Although it may appear to be a digression, yet I cannot help alluding to the state of a wound which has been exposed to the air for three hours. Mr. Liston, I think, remarks, that the surface appears glazed and covered with a gray film, and that, if the surfaces of the wound be now brought in contact, they will be in a most favorable condition for uniting by the first intention. I think the glazed condition, as well as gray film, are attributable to the organic nerves, which, true to their instincts for the preservation of injured parts, have formed a retina over the entire surface of the wound, with a view to its protection and renovation; the sides of the wound being brought in contact, the organic nerves (the *vasa vasorum* of Sir Astley Cooper) inoculate, and union of the divided parts is the immediate consequence.

Mr. Macartney states that a wound can unite without inflammation, and the explanation I have given relative to the organic nerves corroborates the truth of his remark. As a practical rule, therefore, the wound should not be closed for

some time, or until the wound would be dry and glazed. Mr. Hunter stated that the blood in a wound became organized; but it certainly acts as a foreign body, and prevents union by the first intention. No greater improvement in surgery was ever recommended, or based on sounder philosophical principles, than that recommended by Mr. Macartney, of dressing wounds with cold-water dressing; keeping an amputated stump hot, produces inflammation; keeping it cold, arrests inflammation, and its consequences; as a practical rule, therefore, it is proper to keep the cut surfaces of a wound exposed to the air for about three hours, until the surface has become dry and glazed, even although there should be no hæmorrhage or apprehension of hæmorrhage, with a view of healing up the wound in the speediest manner; cold-water dressing is the best application; it is light and cold, prevents the superabundant effusion of lymph, as well as prevents the effusion of serum or pus.

When a person gets into a cold bath, a chilly sensation seizes him; a shock is given to the whole organic nervous system; a feeling of cold is predominant; air is drawn in or inspired, with short and quickly repeated efforts, into the lungs; the surface of the body is made cold by the contraction of the capillary arteries, consequent on the shock by the cold water, to the organic nerves surrounding them, which prohibits the entrance of blood with oxygen into them, and thus shuts off the provision for generating heat by the union of the oxygen with the organic nervous glands. It is necessary, therefore, that some effort should be made to ward off the bad effects induced by the cold, and supply heat; hence, the increased efforts of the pulmonary organic glands to give off more electricity and unite the oxygen of the air with the venous blood, to provide additional fuel for the organic glands, to enable them to resist the shock communicated to them; thus affording one of the strongest proofs of the indivisible connection of the organic nervous glands on the external surface of the body and the pulmonary organic glands; but, notwithstanding the pulmonary glands endeavor to meet the exigency, yet they too are embarrassed, for the cold that has operated on the capillary nerves surrounding the capillary arteries on the external surface of the body, causing their contraction; also by continuity of action, produces a similar state

of the capillary organic nerves surrounding the pulmonary capillary arteries; the organic pulmonary glands suffer from the shock, and have their function of giving off electricity suspended; hence the difficulty connected with the respiration, as already stated. After being in the water a short time, the effects of the shock are over. After swimming for some time, the person will be seized with cramps or spasms of the muscles of the lower extremities. To explain this occurrence, it is necessary to remember that the cold, by its shock, has caused constriction of the capillary arteries through the connection of the organic nerves surrounding and entering into their coats in the first instance. The continuation of the cold not only causes contraction, but likewise spasm of the capillary nerves surrounding the capillary arteries, thus precluding the entrance of the blood with its oxygen, and thus arresting the provision for heating the surface; the organic nerves surrounding the arteries being distributed to the muscles, and the muscular fibres composing the muscles, it follows as a consequence, that spasm of the organic nerves surrounding the arteries cannot take place without spasm of the muscular fibres taking place, to which these arteries and nerves are distributed. No muscle can be wounded without touching a blood-vessel; therefore, no blood-vessel can be wounded without wounding a nerve; or no muscular fibre without touching an organic nerve; hence, spasm of the organic nerves supplying a muscle is attended with spasm of the muscle also. In corroboration of the truth of the doctrine here propounded, it may be necessary, for the satisfaction of persons doubtful of its correctness, to state, that when strychnine is applied to a blistered surface, when the cuticle has been removed, that it will cause spasm of the organic nerves surrounding the capillary arteries; the muscles to which the arteries, with their accompanying nerves, are distributed, are subjected to the action of the strychnine, through their intimate connection with the arteries and nerves. It will be remembered that when the palm of the hand or sole of the foot is torn by a *rusty* nail, or otherwise suffers laceration from violence, that irritation, and eventually spasm of the organic nerves surrounding the capillary arteries, will follow, terminating in the spasm of certain muscles, to which the nerves, circumstanced as stated,

are distributed. Again, in painter's colic, the capillary organic nerves surrounding the capillary arteries, distributed to the muscular canal of the intestines; hence, spasm of the intestinal tube is the result. Another instance is afforded by the spasm of the muscles in Asiatic cholera; it is to be recollected that when a person is attacked with cholera, that there is vomiting, with copious discharges of serum from the bowels. In a very short time all the serum of the blood is drained off, the pulmonary organic glands are exhausted, and unable to discharge their function of giving off electricity to unite the oxygen of the air with the venous blood. Again, there is very little blood left to carry the oxygen over the body; the circulation through the capillaries ceases as a consequence; no blood or oxygen being brought to the organic glands, no heat can be generated; coldness of the surface is the result; the organic glands suffer from irritation; spasm is propagated to the organic nerves surrounding the capillary arteries, to the muscles to which the nerves and arteries are distributed; spasm of the muscles must be the result, and such, in truth, is the fact. It is now proper to ask, What should be the best treatment for a person suffering from cold and spasms produced by immersion in cold water? The answer, after the explanation, must be obvious. In the first place, the person should be thoroughly dried with flannel or coarse cloth—this manipulation implies also friction—the person should be next wrapped up in warm blankets; it should be observed, that if it were practicable to give a warm bath at the onset, it would be the most suitable remedy that could be had recourse to; also a tumbler of hot brandy punch, or, in fact, a hot drink of some kind or other. The philosophy of the treatment scarcely needs explanation. Friction stimulates the organic nerves surrounding the capillary arteries, causing their dilatation, and consequently allowing the entrance of blood with its oxygen—the provision for heating the surface; the heat causes dilatation of the capillary arteries, through its action on the organic nerves surrounding them, and thus provides for warming the body. The warm brandy punch stimulates the organic nerves of the stomach, stimulates the cardiac ganglion, through the connection of the organic nerves of the stomach with the branches of the par vagum, which latter

is connected with the cardiac ganglion, thus increasing the action of the muscular fibres of the heart; the pulmonary ganglion is stimulated also by its connection with the par vagum; thus the pulmonary organic glands are rendered more active in the discharge of their function of giving off electricity to unite the oxygen of the air with the venous blood, and thus make provision for heating the surface of the body. The brandy, as I have elsewhere shown, acts as a stimulant on the organic nervous system all over the body. It causes dilatation of the capillary arteries, through its stimulating effects on the organic nerves surrounding the capillary arteries; thus it will be observed, the brandy increases the muscular power of the heart; increases the power of the pulmonary organic glands; stimulates the organic nerves; makes provision for heating the body, by sending an increased supply of oxygen to the organic nervous glands.

Salt-water bathing is attended with more salutary effects than cold-water bathing. The question arises, Why should this be so? The advantage of the sea-bathing is attributed to different sources; salt water contains a large quantity of chloride of sodium, as well as a considerable amount of phosphorus; the organic nervous system is invigorated by the soda which is brought in contact with it, through the connection of the organic glands with the pores of the skin; the soda thus acts on the pulmonary glands, with which the organic glands of the skin are connected by an indivisible continuity; the pulmonary glands are thus enabled to give off more electricity, and consequently, unite a greater quantity of oxygen with the venous blood; hence the rude and healthy blush which characterizes the robust sailor and athletic fisherman. With respect to the phosphorus—it will be recollected that the animal nervous system is spread all over the body in the shape of a retina; the ultimate filaments of all the animal nerves enter into the formation of the retina. No one can doubt this explanation who pricks any part of the body with a pin, as he will feel pain; the phosphorus is brought in contact with the animal nervous system by immersion in the salt water; the nerves are stimulated by the phosphorus. It is well to remark, that when a man studies hard, phosphorus will be found in the urine, so that

it is evident the brain or animal nervous system suffers, so far as the phosphorus is concerned; the phosphorus of the salt water supplies its place. Thus, it will be observed, sea-bathing invigorates the body and rejuvenates the mind.

When a person takes a shower-bath, there is a shock communicated to the whole organic nervous system; the capillary arteries all over the body are contracted through the shock communicated to the organic nerves surrounding them; the muscles are contracted in consequence of their connection with the arteries and nerves; the frequent inspiration shows that the pulmonary nerves are affected, and evidently shows that they experience the shock; if the shower-bath be continued too long, the patient will fall in the bath; contraction of the capillaries will be followed by spasm of the capillaries and organic glands; the pulmonary organic glands will fail to give off electricity, and animation will be suspended, for the want of oxygen to unite with the venous blood; hence it is that a man will fall under the violence of a shower-bath, as if pierced with a bullet through the heart. I should state that spasm of the muscular fibres of the heart will be also produced by the continuation of the shock caused by the shower-bath; so that the action of the heart being suspended, death follows, as an inevitable sequence, no blood or oxygen being sent to the organic ganglia and glands; the immaterial agent known as life cannot continue the occupant of the organic nervous system; the vital spark becomes extinguished for the want of oxygen, just as a galvanic battery would cease to give off electricity for the want of acid, or as a fire would cease to burn when totally excluded from the air. When a person leaves the bath, and is thoroughly rubbed with a coarse cloth, he will soon experience a glow of heat, and his skin will present a red surface all over: here the friction has stimulated the nerves; the nerves have recovered from the shock, and act with increased vigor; the chastisement they have received from the shower-bath whets their energy for circulating the blood through the capillaries; the circulation is therefore rendered more vigorous, animal heat is increased, strength of the muscles is insured, and the individual rendered buoyant to the highest degree; relaxation of the muscles, with loss of power, cease to render an individual

a burden to himself. Such are the good effects of shower-baths for persons adjudged to require them.

The sulphur bath kills the animalculæ by the sulphur which passes, incorporated with the water, through the pores of the skin.

The iodine bath acts on the organic glands of the skin precisely as if administered by the mouth, and exercises its specific action on the testis, the mammary, parotid, or other glands. It is a curious matter how certain medicines, no matter whether applied by the skin, given by the mouth, or thrown up the rectum, show a predilection for the organic nerves of certain organs.

I wish to remark, that when iodine is administered by means of a bath, or by external application in the way of ointment, or internal administration by the stomach, or internal administration in the shape of vapor by the lungs, that, as soon as its physiological agency on the organic nervous system is established, that the urine, on the addition of starch, will assume a violet color; it therefore follows as a consequence, that the *corpora malpighiana*, or organic renal glands, are charged with iodine; the iodine, therefore, must act on the organic nerves of the kidney; as Bright's disease, or granulated kidney, so called, in consequence of the appearance presented by making a section of it, is characterized by the large quantity of albumen in the urine, as well as the absence of urea, would it not be advisable to give *large doses of iodide of potassium*, to act as an antidote, and eventually exterminate the latent poison that has induced "*Morbus Brightii?*" I am satisfied that iodide of potassium, with the addition of iron, nutriment, and mild stimulants, is the proper mode of treatment, acting on the indications pointed out by physiology.

The nitro-muriatic acid bath acts on the organic nervous glands of the skin, and through these glands, on the organic nerves surrounding the capillary arteries of the liver, enabling this organ to discharge its functions more efficiently, in the elimination of the bile from the blood. The nitro-muriatic acid gives tone and vigor to the nerves, as well as the organic glands; hence the beneficial results which follow the use of these baths

in chronic enlargement of the liver, accompanied with jaundice.

The mode of operation of the various kinds of baths affords strong proof of the great importance of a thorough knowledge of the organic nervous system. My object being to expound clearly the truths connected with the nervous system, I trust I will be excused for making repetitions. I am most anxious to avoid being mysterious, as well as to attract that grave attention to the subject its great importance demands.

I trust I will be pardoned when I state that the nervous system cannot be understood without great study and reflection. Let me not be misunderstood. I am fully aware of my own *shortcomings*, and will still continue to be a *student*.

NOTES.

(Note A.)—Irritation, as in the case of the temporal artery, will produce alternate contraction and dilatation of the organic nerves surrounding the mouths of the arteries, if persistent irritation be kept up, as exemplified when a child is cutting a tooth, contraction and relaxation of the nerves surrounding the capillary arteries on which the tooth is passing must be the consequence; when the irritation becomes very great, it is propagated to the entire organic nervous system, that is to say, to the organic nerves surrounding the arteries all over the body, as well as to the muscles to which the arteries are distributed; hence the alternate relaxation and contraction of the muscles which follow the disturbance is propagated to the brain through the organic nerves surrounding the arteries at the base of the brain, and distributed to the peripheral surface of the brain; hence the operation of the mind ceases, and the person becomes insensible to external objects. I stated that the arteries were distributed to the peripheral surface of the brain, for the reason that no arteries appear to be distributed to the substance of the brain, a circumstance I had ample proof of in making the vivisections of the sheep.

Irritation by worms in the intestinal tube, or indigestible substances, causes irritation of the organic nerves, and is followed by convulsions, as in the case of dentition; convulsions produced by masturbation can be explained in the same way, as well as convulsions of other kinds, which can be traced to irritation of the organic nerves.

(Note B.)—In a medico-legal point of view, it is a very desirable matter to be able to explain why an infant, that an *honest midwife* or *indiscreet lady* has roughly thrown in a state of complete nudity into a sink, water-closet, or coal-hole, is subsequently found crying by an individual, who *charges* the midwife or other persons with a murderous intent to destroy the infant's life; it is quite true that an infant may be born to all appearance dead, and may continue in that state for a longer or shorter period, and eventually, under judicious management, be restored to life; it is also well known that infants when, after the

usual treatment to restore animation was had recourse to, and apparently in vain, were restored to life on being thrown in a cold room.

In a case such as the one above described, the infant is in a state of extreme exhaustion and vital prostration; on the body of the infant being exposed to the draught of cold air, all the organic nerves become constricted, firm, and strengthened; the arterial trunks and their capillaries become constricted, so that the blood is forced out of them; the muscular fibres of all the muscles, together with the muscular fibres of the heart, are contracted in consequence of the connection of the organic nerves with the muscular fibres. It will be remembered, contraction of the capillary arteries cannot take place without causing contraction of the muscles to which the arteries are distributed, in consequence of the connection between the capillary arteries and organic nerves which surround them; contraction of the arteries with their capillaries, as well as contraction of the muscles, is followed by increasing the quantity of blood in the veins; the venous blood is sent by the contraction of the muscles to the right auricle of the heart; the auricle now contracts through the agency of the cardiac nerves from the right auricular cardiac ganglion; the blood passes into the right ventricle, the latter next contracts and sends the blood by the pulmonary artery and its branches to the pulmonary organic glands, which are formed by the retina of organic nerves surrounding the pulmonary arteries at their terminations, and which are derived from the pulmonary ganglion, which is placed in juxtaposition with the cardiac ganglion; as soon as the blood reaches the glands, the infant gives evidence of its having done so, and the pulmonary glands, true to their office, demand air; the child opens its mouth, makes an inspiration, the air rushes in; on the air coming in contact with the organic pulmonary glands it stimulates the glands, which give off electricity, which causes the union of the oxygen of the air with the venous blood as it is circulating through the pulmonary organic glands; the blood, being now charged with oxygen, is conveyed to the left side of the heart, and from the heart all over the body, by the arteries which terminate in capillaries; the arteries are surrounded by a retina of organic nerves, which are prolonged over their coats, and form glands at their extremities; the blood, on passing through these glands, gives off the oxygen to the glands. The immaterial agent known as life is now enkindled, and commences its operation all over the body, as fully announced by the crying of the child; thus it will be perceived that the offspring of the poor and unfortunate are restored to life by exposure and privation, whilst that of the rich are

doomed to certain death, engendered by the hot-bed of luxury which surrounds them, on being placed under similar circumstances as regards the asphyxiated condition described. An infant supposed to be dead, in the one case, is wrapped up in warm flannel, placed in a warm bed, in a warm room, to be looked at and gazed on as an untold loss, until it sleeps quietly in death; whilst in another case, the parties about the infant are only too happy that the little innocent has escaped the miseries of this wicked world, and summarily throw its body into such a place as will cause the infant to wake up into life.

(Note C.)—It may be stated that "the dropped hand" that painters are afflicted with, affords an example of paralysis, by poisoning from lead. This view of the matter cannot be sustained; the pronators and flexors of the forearm are suffering from spasm, a matter that any person can satisfy himself about on making an effort to extend the fingers of the affected hand, when he will find considerable muscular power opposed to his doing so; therefore, in "dropped hand" there is spasm of the pronators and flexors, whilst the supinators and extensors are in a normal condition; here, it would not be proper to administer strychnine, for it would be only producing additional spasm; the proper medicine should be iodide of potassium to neutralize the lead poison, and chloroform in the shape of a liniment to allay the spasm of the organic nerves surrounding the capillary arteries, and consequently spasm of the muscles to which the arteries are distributed. The hand should be next rubbed with a coarse cloth, several times daily.

(Note D.)—Dr. C. L. Mitchell speaks in high terms of ergot of rye in the treatment of that very troublesome and unmanageable disease called spermatorrhœa. I am satisfied his statement is correct, and that it is an excellent medicine for the disease in the mode prescribed by him. The ergot of rye arrests hæmorrhage from the uterus, by its causing spasm of the organic nerves surrounding the capillary arteries; contraction of the arteries is the result. No blood can enter the arteries, consequently none can flow from them; spasm of the capillary arteries is followed by spasm of the muscular fibres of the uterus; thus, an additional safeguard is presented for the arrest of the hæmorrhage.

In cases of diarrhœa, the ergot causes spasm of the capillary nerves surrounding the capillary arteries, causing contraction of the arteries. No blood can enter the arteries; consequently, there is no material for

the organic glands to operate on for the production of mucus or serum; in addition, contraction of the muscular coat of the intestinal tube follows as a sequence of contraction of the capillary arteries, which are distributed to the muscular fibres of the intestinal tube; hence it happens that the discharge from the bowels is arrested.

In cases of spermatorrhœa, it causes spasm of the muscular fibres of the prostate gland, (see Thompson on Prostate Gland,) in the same way that it causes spasm of the muscular fibres of the uterus: the organic nerves surrounding the capillary arteries which supply the prostate gland are contracted; the muscular fibres of the prostate gland, through their connection with the capillary arteries, are contracted; hence the common seminal ducts, which open at the anterior part of the verumontanum, after passing through the prostate gland, are completely occluded and prevented from discharging their contents into the urethra, by the pressure exercised on them by them, by the contracted prostate gland. Ergot of rye would, therefore, appear to act specifically on the organic nerves of the male and female genital organs; the action of the ergot of rye would further go far to demonstrate the identity in structure of the uterus and prostate gland.

(Note E.)—The reason why strychnine and nux vomica are given as medicines with a view to restore the power of the muscles in cases of paralysis, can now be understood: the strychnine, as well as nux vomica, produces spasm of the nerves surrounding the capillary arteries; contraction of the capillary arteries is the result. As the capillary arteries supply the muscular fibres with blood, contraction of the capillaries must necessarily be attended with contraction of the muscles to which the arteries are distributed, and in this way the medicine acts, as every practitioner knows who has observed the spasm of the muscles which follows the administration of strychnine or nux vomica.

230 Washington Square, South,
New York, May 17th, 1861.